



**Life Cycle Engineering, Inc.**

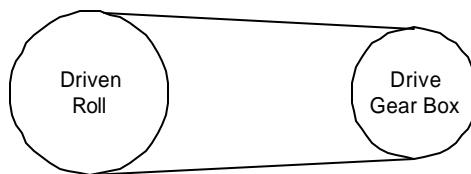
## **Roller Chain Maintenance**

## Introduction

Chain drives are an important part of a many mechanical power transmission systems. They are used to transmit needed power from the drive unit to a portion of a piece of equipment.

## Chain Drives

Chain drives are used to transmit power between a drive unit and a driven unit. For example, if we have a gearbox and a contact roll on a conveyor, we need a way to transmit the power from the gearbox to the roll. This can be done easily and efficiently with a chain drive unit.



Chain drives can consist of one or multiple strand chains, depending on the load that the unit must transmit. The chains need to be matched with the sprocket type and they must be tight enough to prevent slippage.

### *Chain Drive Advantages*

1. Unlike belt drives, chain drives do not slip, therefore there is no power loss due to slippage, which means they are more efficient
2. More compact than belt drives. For a given capacity, chain drives are narrower than belt drives, and the sprockets are smaller in diameter than the sheaves on a belt drive.
3. Chain drives are more practical at slow speeds, yet will operate efficiently at high temperatures.
4. Chains are generally easier to install than belts.
5. Chains are not subject to deterioration by oil, grease, or sunlight, and generally withstand chemical and abrasive conditions.
6. Chains can operate in wet conditions.
7. Chain stretch under normal operating conditions is slow, and chains require less take-up adjustment than do belts.
8. Chains are very effective in driving several shafts from one common drive shaft.
9. Chain drives are generally simpler and less costly than gear drives, and can be used with varying shaft center distances.
10. Chains are suitable for use on reversing drives.

### *Chain Drive Disadvantages*

1. Chains cannot be used where the drive must slip, and cannot except much misalignment.
2. Chains are noisy and may cause vibration within the machinery, and require frequent lubrication.
3. As compared to gear drives, chain drive load capacity is generally smaller and service life shorter.

## ***Chain Drive Principles***

Chains are used to transmit power from one rotating shaft to another. On a typical chain drive, the drive and driven sprockets rotate in the same direction, and maintain a positive speed ratio for the machine.

In most applications, a chain that has an even number of pitches will be used on a sprocket with an odd number of teeth, and a chain with an odd number of pitches will be used on a sprocket with an even number of teeth. This limits developing a wear pattern on the sprockets, by having different links of chain contacting the sprocket teeth on different revolutions, similar to that of using not whole number gearing ratio to limit the wear on gear teeth.

### ***Power transmission Chain Types***

There are six basic styles of chains used in power transmission applications. They are the roller chain, Detachable link (plain) chain, Pintle chain, Silent Chain, Leaf chain, and the Laminated metal chain. We will discuss the roller chain and the detachable link chain in this course.

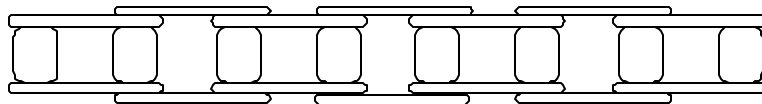
## **Chain Selection**

### ***Roller chain***

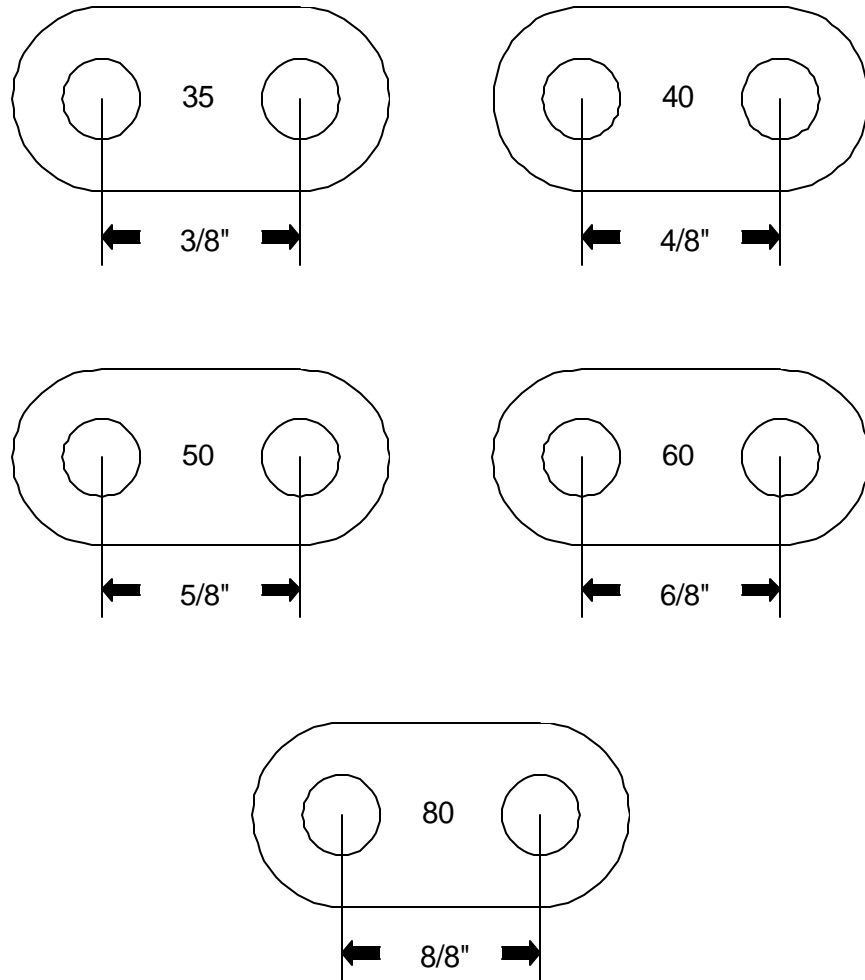
There are many styles of Roller chains available. We will limit our discussion to the standard roller chain for the most part. Roller chains are made up of roller links that are joined with pin links. The links are made up of two side bars, two rollers, and two bushings. The roller reduces the friction between the chain and the sprocket, thereby increasing the life of the unit.

Roller chain can operate at faster speeds than plain chains, and when properly maintained, they will offer years of reliable service.

Some roller chain come with a double pitch, meaning that the pitch is double that of a standard chain, but the width and roller size remains the same. Double-pitch chain can be used on standard sprockets, but double-pitch sprockets are also available. The main advantage to the double-pitch chain is that it is cheaper than the standard pitch chain. So, they are often used for applications that require slow speeds as in for lifting pieces of equipment, like in a hot press application.



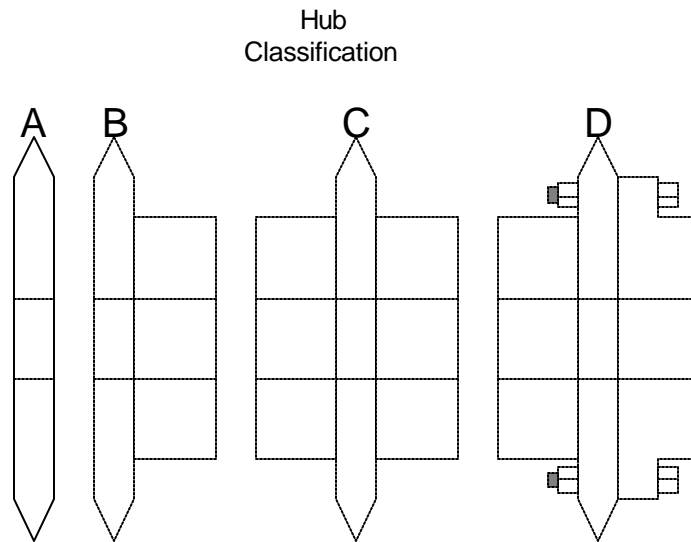
Roller chain is sized by the pitch or the center-to-center distance between the pins. This is done in 1/8" increments, and the pitch number is found on the side bars of the chain. Examples of the different chain and sprocket sizes are as follows:



Sometimes chains are linked to form 2 multi-strand chains. The number designation for this chain would have the same pitch number, as standard chain, but the pitch would be followed by the number of strands (80-4).

## Sprockets

Sprockets are fabricated from a variety of materials; this would depend upon the application of the drive. Large fabricated steel sprockets are manufactured with holes to reduce the weight of the sprocket on the equipment. Because roller chain drives sometimes have restricted spaces for their installation or mounting, the hubs are made in several different styles.



Type A sprockets are flat and have no hub at all. They are usually mounted on flanges or hubs of the device that they are driving. This is accomplished through a series of holes that are either plain or tapered.

Type B sprocket hubs are flush on one side and extend slightly on the other side. The hub is extended to one side to allow the sprocket to be fitted close to the machinery that it is being mounted on. This eliminates a large overhung load on the bearings of the equipment.

Type C sprockets are extended on both sides of the plate surface. They are usually used on the driven sprocket where the pitch diameter is larger and where there is more weight to support on the shaft. Remember this: the larger the load is, the larger the hub should be.

Type D sprockets use a type A or B sprocket mounted on a solid or split hub. The sprocket is split and bolted to the hub. This is done for ease of removal and not practicality. It allows the speed ratio to be changed easily by simply unbolting the sprocket and changing it without having to remove bearings or other equipment.

# Chain Installation

## *Chain Drive Factors*

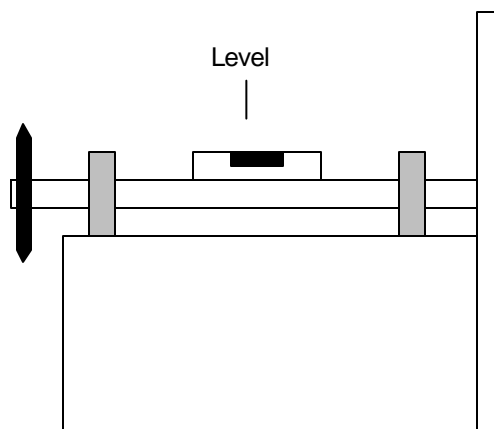
The slack on the chain should be located on the bottom strand. It is desirable that a chain wrap of 120 degrees is achieved, but under no circumstance should the chain wrap be less than 90 degrees.

In vertical chain drive arrangements, the chain will tend to hang off the lower sprocket. This is especially true if the driver sprocket is at the lower position. Therefore, it is desirable that the shaft centers be arranged such that they are at least 20 degrees off true vertical.

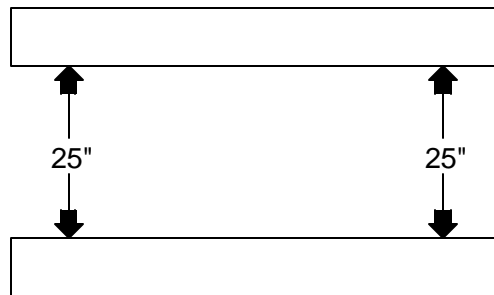
When the proper procedures are followed for installing chains, they will yield years of trouble-free service. Use the following procedure to perform this task:

## *Installation*

1. The shafts must be parallel or the life of the chain will be shortened. The first step is to level the shafts. This is done by placing a level on each of the shafts, then shimming the low side until the shaft is level.

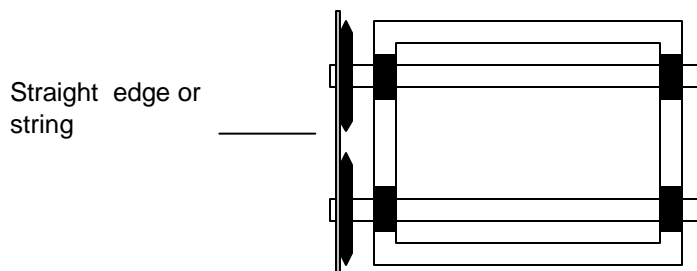


2. The next step is to make sure that the shafts are parallel. Measuring at different points on the shaft, and adjusting the shafts until they are an equal distance apart does this. Make sure that the shafts are pulled in as close as possible before performing this procedure. The jacking bolts can be used to move the shafts apart evenly after the chain is installed.



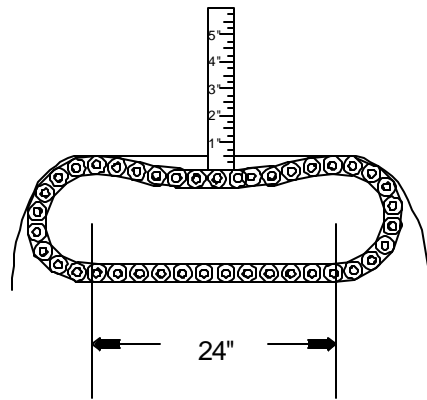
3. Before installing a set of used sprockets verify the size and condition of the sprockets.

4. Install the sprockets on the shafts following the manufacturer's recommendations. Locate and install the first sprocket, then use a straightedge or a string to line the other one up with the one previously installed.

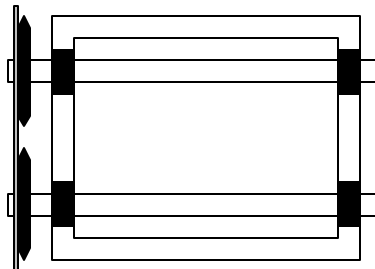




5. Install the chain on the sprockets, then begin increasing the distance between the sprockets by turning the jacking bolts; do this until the chain is snug but not tight. To set the proper chain sag deflect the chain 1/4" per foot of span between the shafts. Use a string or straightedge and place it across the top of the chain. Then push down on the chain just enough to remove the slack. Use a tape measure to measure the amount of sag.



6. Do a final check for parallel alignment. Remember: the closer the alignment, the longer the chain will run.



## ***Chain Length***

Many times when a mechanic has to change out chains there is no way of knowing how long the chain should be. One way is to lay the new chain down beside the old chain, but remember that the old chain has been stretched.

Or, maybe you are installing a new drive and you want to have the chain made up before you install it. So what do you do? One method is to take a tape measure and wrap it around the sprockets to get the chain length.

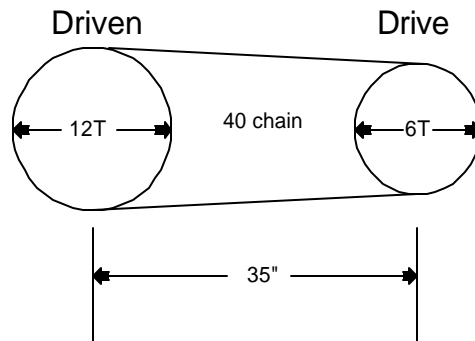
However, this is not a very accurate way to determine the length. Instead, let's take a couple of measurements, then use a simple formula to calculate the actual length that is needed.

First, move the sprockets together until they are as close as the adjustments will allow. Then move the motor or drive out 1/4 of its travel. Now we are ready to take our measurements. The following information is needed for an equation to find the chain length:

1. Number of teeth on the drive sprocket.
2. Number of teeth on the driven sprocket.
3. Center-to-center distance between the shafts.
4. The chain pitch in inches.

Now use the following formula to solve the equation:

$$\text{Chain Length} = \frac{\# \text{ teeth drive} \times \text{pitch}}{2} + \frac{\# \text{ teeth driven} \times \text{pitch}}{2} + \text{Center to center} \times 2$$

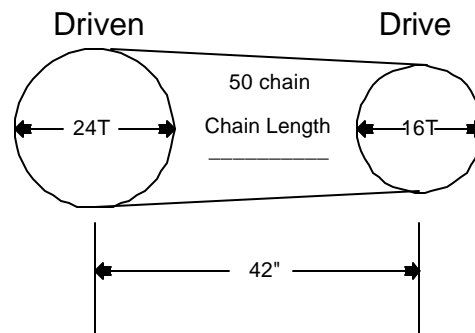
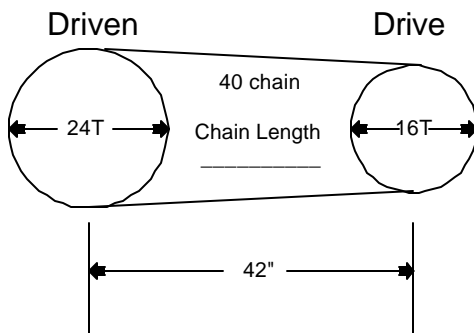


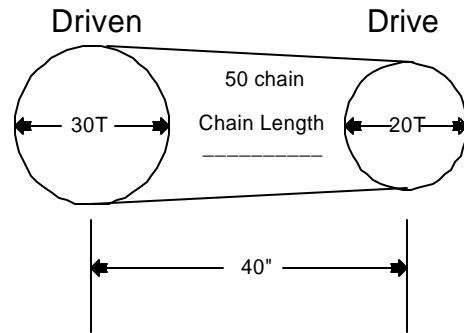
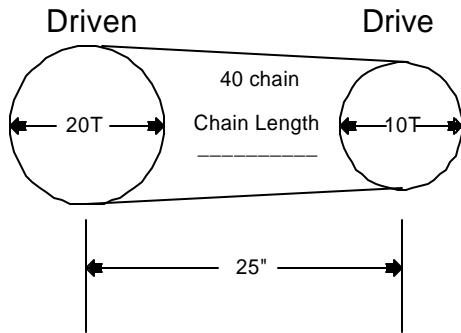
Use the formula above to find the chain length.

$$\text{Chain Length} = \frac{6 \times .5}{2} + \frac{12 \times .5}{2} + 35'' \times 2$$

$$74.5'' = \frac{6 \times .5}{2} + \frac{12 \times .5}{2} + 35'' \times 2$$

Find the chain length for the follow units:





## Chain and Sprocket Inspection

Like other mechanical operating devices, roller chains require maintenance attention to obtain a long satisfactory operation life. Periodic inspections done to identify problems or potential problems at their earliest stages will pay great dividends in extending chain drive component lives, and preventing costly unexpected shutdowns.

### *Chain Inspection*

Chain cleanliness and proper lubrication are vital to your chains long life. Foreign material left on the chain can have an abrasive effect when mixed with the lubrication and cause excessive wear.

Check for evidence of wear. If the inside surfaces of roller chain link sidebars appear to be worn, then the drive is probably misaligned, and the alignment should be checked. This type of problem will also result in wear on the side of the sprocket teeth.

Inspect chain for flexibility. Stiff chain joints can be a result of dirt or grit in the rollers.

Inspect the amount of chain stretch or elongation. A single pitch roller chain should be replaced if the amount of stretch is equal to or greater than 3 percent of its original length.

Check for any signs of physical damage to the chain, such as broken or cracked parts, loose pins and bushings, or indications of corrosion.

### *Sprocket Inspection*

As previously discussed, the side of the sprocket teeth should be inspected for signs of wear, indicating a possible alignment problem.

Check the teeth for signs of wear, indicated by a “hooked” shaped. This is normal wear, which may have been accelerated by a loose fitting chain. In some cases it is possible to turn the sprocket around, and extend its life.

Inspect for signs of physical damage to the sprocket, such as broken or chipped teeth, or excessive corrosion.

Check the sprocket runout on the shaft, and inspect the keys and keyways for wear or damage.